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[54] **COMBINING GPS WITH TOA/TDOA OF CELLULAR SIGNALS TO LOCATE TERMINAL**

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[58] **Field of Search** 342/357, 457; 701/213; 455/456

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[57] **ABSTRACT**

Aspects of global positioning system (GPS) technology and cellular technology are combined in order to provide an effective and efficient position location system. In a first aspect of the invention, a cellular network is utilized to collect differential GPS error correction data, which is forwarded to a mobile terminal over the cellular network. The mobile terminal receives this data, along with GPS pseudoranges using a GPS receiver, and calculates its position using this information. According to a second aspect, when the requisite number of GPS satellites are not in view of the mobile terminal, then a GPS pseudosatellite signal, broadcast from a base station of the cellular network, is received by the mobile terminal and processed as a substitute for the missing GPS satellite signal. A third aspect involves calculating position using GPS when the requisite number of GPS satellites are in view of a GPS receiver, but when the requisite number of GPS satellites are not in view of the GPS receiver, then position is calculated using the cellular network infrastructure. When the requisite number of GPS satellites come back into view of the GPS receiver, then position is again calculated using GPS. A fourth aspect involves using cellular signals already being transmitted from base stations to terminals in a cellular network to calculate a round trip delay, from which a distance calculation between the base station and the terminal can be made. This distance calculation substitutes for a missing GPS satellite signal.

17 Claims, 11 Drawing Sheets